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ABSTRACT

This guide provides basic information to meet specific standards for pesticide applicators. The text is concerned with the control of economic insect pests on field and forage crops, especially corn, soybeans, and alfalfa. Full color photographs of the more destructive pests are provided to aid in identification of problems. Precautions and special considerations in applying pesticides are also discussed. (CS)

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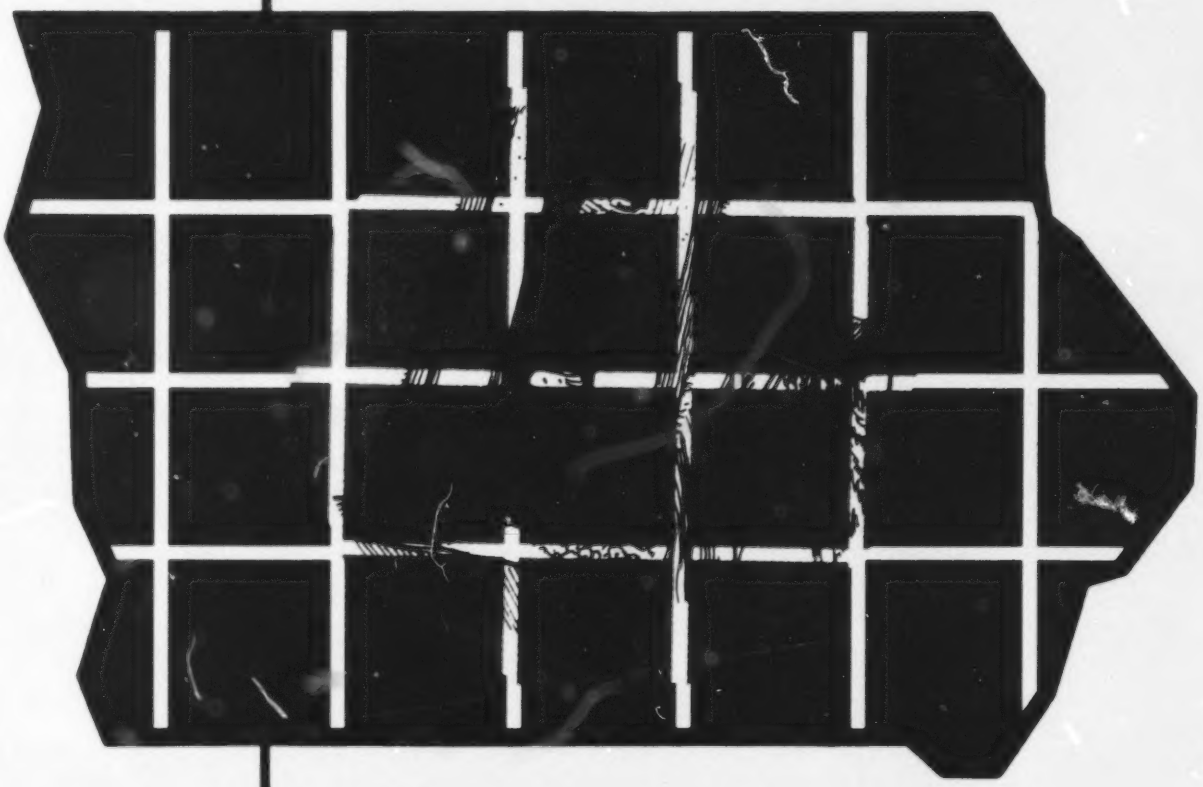
Iowa
Commercial Pesticide Applicator Manual

CATEGORY 1B

AGRICULTURAL INSECT CONTROL



This manual is to be used for certification training in conjunction with the U. S. Department of Agriculture – U. S. Environmental Protection Agency manual, **Apply Pesticides Correctly,** EPA-335.

Cooperative Extension Service
IOWA STATE UNIVERSITY
Ames, Iowa 50011

CS-10
January 1976

This manual has been developed for individuals wishing to become certified in commercial pesticide applicator category 1B, Agricultural Insect Control. It contains specific information that an individual must know before becoming certified in category 1B. The manual has been designed to supplement the general information contained in the core manual, **Apply Pesticides Correctly—A guide for commercial applicators** (plus an Iowa State University supplement) and should not be used for certification preparation without referring to the core manual as well.

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Prepared by Harold J. Stockdale, extension entomologist, and Stephen O. Ryan, pesticide training coordinator, who express appreciation to the University of Georgia for the use of source material.

Iowa State University of Science and Technology
Cooperative Extension Service
Ames, Iowa 50011

Entomology
Insectary Building
Telephone 515-294-1101

September 21, 1976

Commercial Applicator:

Recent Environmental Protection Agency (EPA) decisions and certain pesticide-use patterns in Iowa require the need for this additional information for your category manual. Please attach these sheets to Category Manual 1-B, Agricultural Insect Control.

Gerald R. DeWitt
Pesticide Training
Coordinator

JRD:jm

CS-10A

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STATUS OF CHLORINATED HYDROCARBONS

ALDRIN: The production of aldrin for use as a soil insecticide treatment for corn production was suspended by the EPA in 1974. Products on farms or in distribution channels, however, can continue to be used legally according to label directions.

HEPTACHLOR AND CHLORDANE (BELT): Most uses of these insecticides were suspended on July 29, 1975. A suspension hearing was held, and on December 24, 1975 EPA Administrator Train issued the following statement:

> --Heptachlor and/or chlordane produced prior to July 29, 1975 can be distributed, sold and used for purposes stated on the label.
>
> --Heptachlor and/or chlordane produced after July 29, 1975 can be used only for limited and specific uses, including cutworm control on corn, until August 1, 1976.

Heptachlor and chlordane that was formulated and distributed after July 29, 1975 has been located by EPA, and a "Stop Sale" has been placed on the material. Selling or distributing a "Stop Sale" product is a violation. Chlordane and heptachlor in supply channels that are not under a "Stop Sale" order can be used according to label directions.

INSECTICIDES AND HONEYBEES

In 1976, the number of reported honeybee kills increased greatly in Iowa. This most likely was due to the increased number of insecticide applications made to alfalfa for alfalfa weevil and leafhopper control and to field corn for adult corn rootworm control.

Commercial applicators should be aware of the local bee yards within one mile of an application field. Beekeepers should be notified of intended insecticide applications. Losses of bees to pesticides can be minimized by understanding several basic principles:

—Apply proper rates and follow label recommendations.

—Ground application is safer than aerial application.

—Avoid excessive drift.

—Emulsifiable concentrates are safer than wettable powders.

—Granules are least hazardous to the bees.

—Safest applications are before 7:00 a.m. and after 7:00 p.m.

Beekeepers should be encouraged to notify adjacent farmers and commercial applicators of bee yard locations and seasonal changes in site locations. Honeybees are beneficial insects and an important aspect of Iowa's agriculture. Beekeepers and commercial applicators must cooperate in order to protect this resource.

RELATIVE TOXICITY OF PESTICIDES TO HONEYBEES

Highly Toxic

Severe losses may occur when bees are present during treatment or within 24 hours.

aldrin	diazinon	Imidan
arsenicals	Dibrom	Lannate
Baytex	EPN	malathion
Cygon	Furadan	methyl parathion
Dasanit	Guthion	Rabon
DDVP (Vapona)	heptachlor	Sevin

Moderately Toxic

Proper timing and application of these pesticides will not cause severe losses. *Do not* apply to exposed bees in the field or at the colonies.

chlordane	Korlan
Co-Ral	Meta-Systox R
Di-Syston	Thimet

Relatively Nontoxic

These can be used around bees with a minimum of injury.

INSECTICIDES—	
Dylox	pyrethrin
methoxychlor	toxaphene
FUNGICIDES—	
Arasan	Du-TER (TPTH)
Benlate	Manzate
bordeaux mixture	sulfur
captan	Zerlate
Dithane	
HERBICIDES—	
atrazine	paraquat
Banvel	Princep
Eptam	2,4-D
Lasso	2,4-DB
Lorox	2,4,5-T
MCPA	

CROP PRODUCTION

Modern, efficient agriculture produces crops on large, continuous acreages of land. Unfortunately, this type of agriculture encourages invasion of the crops by a wide variety of damaging pests. Therefore, production of these crops also requires the use of large quantities of pesticides to produce the quantity and quality of products needed by man. The productivity of modern agriculture is probably the most important underlying factor that gives the United States the highest standard of living in the world.

Agricultural crops may be divided into field and forage crops, vegetable crops and orchard crops. The necessity of pesticides for maximum production of high quality products has been documented many times by research and experience. The quality of products grown without the use of pesticides is generally much lower, and, in many instances, too low to be accepted for market.

Proper care must be exercised in applying pesticides to any crop. Methods of application vary widely with some being more dangerous to the applicator than others. For example, spraying orchard trees where the pesticide is applied above the head of the applicator is much more hazardous than applying chemicals to a low growing field or forage crop.

When planting crops, consideration should be given to the pesticides that will be used during the production season, the methods of application that will be employed and whether either of these considerations presents any problem for adjacent nontarget areas such as bodies of water, woodlands, urban areas and other crops that may become contaminated. Every effort should be made in planning to at least minimize these problems and prevent them if possible.

Changes in registrations of old pesticide products or new product registrations may occur before each cropping season. Carefully read the label before using any pesticide.

THE CONTROL OF ECONOMIC INSECT PESTS ON FIELD AND FORAGE CROPS

Insecticides are tools used in agricultural production to protect crops from insect attack. They are only one way of controlling insects. Other insect control methods including crop rotation, planting resistant varieties, early harvest, etc. are also effective ways to "manage" insect populations at below economic levels.

Following is a summary of the economically important insect pests on field and forage crops in Iowa:

CORN INSECTS — BELOW GROUND

(Also See Picture Sheet No. 5)*

Insects Attacking Seed

Because some seed-attacking insects are resistant to the chlorinated hydrocarbon insecticide seed treatments (heptachlor, lindane), planter box diazinon-graphite mixtures should be used except where rootworm insecticides are used. Protection from seed-attacking insects is most important on early-planted fields. (Note: a percentage of the seed treatment is removed from the seed in air planters.)

Insects Attacking Continuous Corn

Corn producers who have observed rootworm damage in spite of a properly applied insecticide should consider rotating to another crop on these heavily infested fields. Also, they should avoid using the same soil insecticide year after year. In recent years, many of the apparent rootworm "failures" occurred where a particular insecticide had been used on the same field for three to four years in succession.

Planter application: Granular formulations of Counter, Dasanit, Dyfonate, Furadan, Lorsban, Mocap and Thimet are recommended to be applied in a 7-inch band at planting time.

Liquid formulations of Furadan, Dasanit and

*Insect pests that are included on the picture sheets but not discussed in the text need not be studied for purposes of certification.

Dyfonate can be mixed with water and applied per label directions or mixed with liquid fertilizer and applied in a band on both sides of the row. *It is extremely important that label directions be followed specifically when handling and mixing these liquid formulations; they are more toxic and hazardous than granular formulations.*

Cultivator application: Dasanit, Dyfonate, Furadan, Mocap or Thimet can be applied with a cultivator applicator as a basal treatment lightly covered with soil.

Cutworms

Low-lying fields subject to flooding or with poor drainage and with some of last year's crop residue on the surface may experience cutworm infestations regardless of the crop rotation. Traditionally, row or broadcast applications of aldrin, heptachlor and chlordane have been used to control cutworms on these high risk fields. Environmental Protection Agency actions have drastically limited production of these three insecticides. If available, they are still legal to use on non-dairy farms and are recommended, although only very limited supplies will be available.

On dairy farms and in situations where aldrin, heptachlor and chlordane are not available, applicators will have to rely on early diagnosis of cutworm activity and the immediate application of emergency baits or sprays. On such farms, small corn should be watched closely from May 20 to June 15, and when leaf feeding and/or cutoff plants are observed on 5 percent of the plants, Sevin bait broadcast or Sevin and Dylox as over-the-row sprays should be applied. Non-dairy farms can also use a toxaphene spray application. Sprays should not be broadcast because a concentration of the material over the row will give more effective control.

Insects Attacking First-year Corn Following Sod

Where corn follows grass or legume-grass sod, one or more insects, particularly wireworms, white grubs, sod webworms and/or corn billbugs may be present in sufficient numbers to cause economic damage. Traditionally, row or broadcast applications of chlorinated hydrocarbon insecticides (aldrin, heptachlor or chlordane) have been used to control first-year corn insects. These materials are again recommended on non-dairy farms, but since they may be unavailable, alternative insecticides labeled for wireworm control are also listed below.

Non-dairy farms: A furrow application of aldrin, heptachlor or chlordane will give best results against wireworms, white grubs or glassy cutworms. Black cutworms, sod webworms and corn billbugs are controlled best by applying the insecticide in a 7-inch band.

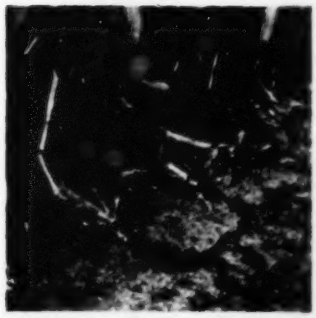
Dairy farms or when aldrin, heptachlor and chlordane are not available: Furadan may be applied as a furrow or band application or Thimet, Mocap or Dasanit may be applied in a 7-inch band for the reduction of wireworm populations. An applicator should be prepared to apply Sevin as a bait May 25 to June 10 if cutworm damage occurs.

CORN INSECTS—BELOW GROUND

For safe and effective use of insecticides, always identify the problem correctly.

1. Corn rootworm adults (top-bottom: Northern, Western and Southern)

2. Corn rootworm larva



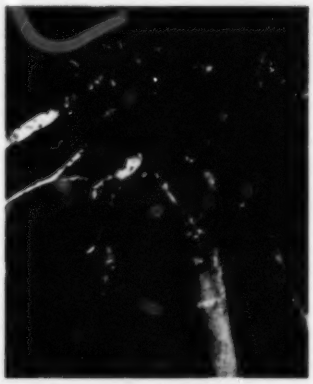
3. "Goose-neck" symptoms of corn rootworm infestation

4. Corn rootworm damage

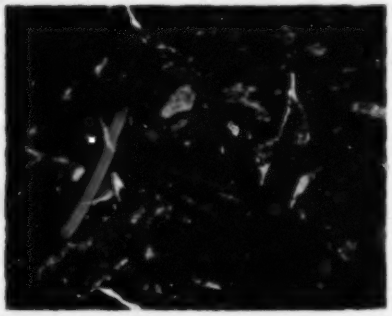
5. Wireworm

6. White grub

7. Black cutworm

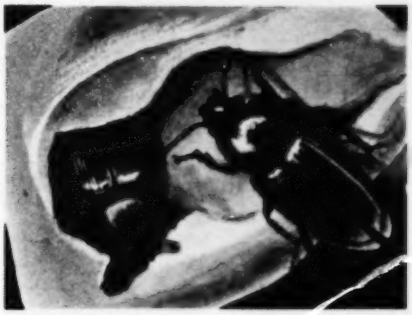


8. Corn root aphid



9. Grape colaspis and damage

10. Seed corn maggot



11. Seed corn beetle

12. Billbug (feeds on seedling corn plants below ground; holes in lower leaves of larger corn are evidence of this earlier feeding)

Prepared by Extension Entomologists of the North Central States in cooperation with the Federal Extension Service, U. S. Department of Agriculture

CORN INSECTS -- BELOW GROUND

1. **Northern corn rootworm adults** are green or tan beetles 1/4-inch long. They emerge from soil of cornfields in July and August to feed on corn silks and pollen, sometimes to the extent of preventing pollination. Beetles lay eggs in cornfield soils from July until frost. Eggs hatch in June of the following year and if corn is planted in the field, larvae feed on roots during June and July.

   Western corn rootworm beetles are tan or green with three black stripes running down the back. Adults do more damage to corn silks and leaves than the Northern species. Life histories of the two are similar, but the Westerns seem more active and are stronger fliers.

   Southern corn rootworm adults fly into Iowa from the South in late May and early June. They feed on corn leaves in any field. Eggs are laid in the soil at the base of corn plants. Adults are larger than those of the Northern and Western species, and are also called spotted cucumber beetles. There are at least two generations in Iowa each year.

2, 3,4, **Corn rootworm larvae** are especially destructive to roots of nodes 4, 5, and 6. Damage isn't seen until a rain and windstorm in July or August lodges the corn. With a reduced root system the lodged plants struggle along and some of them straighten up, resulting in "goosenecked" plants. Yield losses of 10 to 80 bushels an acre have been observed in Iowa due to rootworms.

5. **Wireworms**, which are pests of corn in Iowa, are yellow to brown in color, shiny in appearance and definitely segmented. Length of the larval life is estimated at 3 to 5 years. Adults are beetles 3/8-to 5/8-inch long, slender, dark, and have the habit of "snapping" their bodies to right themselves when placed on their back. This habit gives them the common name of "click" beetles. Feeding takes place on corn seed, seedlings, and roots, as well as on decaying organic matter in the soil at depths determined by temperature. Wireworms are generally a problem on row crops following sod.

6. **White grubs** are the larvae of several species of June beetles which may attack roots of corn and other grasses. They eat off corn roots, and the plants wilt and die. Most adults feed on tree leaves and lay eggs in grass sod. Corn following sod may be seriously damaged. One species that we know of feeds on soybean leaves and may lay eggs in the bean field. Corn following beans is then attacked.

7. **Black cutworms** are also called overflow cutworms since they show up in corn planted in wet fields or in fields subject to flooding. Moths emerge from pastures and other grassy areas in August and September. They lay eggs in grassy alfalfa and clover, and in grassy corn and soybean fields. Eggs hatch in 5 to 10 days and larvae feed on the grass and hide during the day in the soil. Larvae and adult moths overwinter. Larvae come to the surface at night and cut off young corn plants. They pupate in the soil and moths emerge about July 1 to 10. There are two generations.

8. **Corn root aphids** are small, blue-green sucking insects that are placed on corn roots by cornfield ants. The ants tend the aphids for the sweet sticky honeydew which the aphids excrete. This species feeds only on roots and could not survive if ants were not present. If growing conditions are good, there is no obvious damage, but when aphid numbers are high and soil moisture is below normal, corn 20 to 30 inches high shows red leaves and is stunted. Plants do not die, but yields are reduced. Ants collect aphid eggs and store them over winter.

9. **Grape colaspis** larvae feed on roots of corn planted on clover sod. Adults are small, oval, golden-brown beetles that lay eggs during the summer in red clover fields. Larvae are less than a quarter inch long, white, curved, with a brown head and six short legs. They live through the winter in the soil and begin feeding on corn roots soon after the corn comes up. When the corn is 12 to 18 inches high, leaves turn red and growth slows down or stops. Feeding may cause root lodging. In good growing seasons, corn survives and may produce a partial crop.

10. **Seed-corn maggots** are the larvae of a fly smaller than the house fly, generally gray in color, with relatively long legs. These flies can be found in and above every planted corn and soybean field during spring. They prefer to lay their eggs where there is an abundance of decaying organic material. Heavy soils, slow to warm up in the spring, are likely to harbor many maggots.

11. **Seed-corn beetles** eat the germ from planted seed corn and do the most damage during cold wet springs. They are about a quarter inch long, tan with two dark lines on each wing cover. They are active at night and run into cracks or under clods when disturbed during the day. Another species not pictured, *Clivina impressifrons* are uniformly reddish-brown in color, 1/4-inch long, and their bodies are constricted between the thorax and abdomen. They do damage similar to the seed corn beetles.

12. **Billbugs** often damage seedling corn plants. Adult beetles are 1/4-to 3/4-inch long, black, with a long snout. They eat into the young corn plant at ground level, and as the leaves grow out, there are rows of holes across each one. Adults are hard to see because of their color and because they play dead when disturbed. Eggs are laid in the corn stalk where the emerging larvae feed, usually killing the plant before July 15. Larvae are white, curved, legless, with brown heads. Another species has a clay-colored adult about 1/2 to 3/4-inch long with darker markings on the back. It lives in low areas and destroys young corn plants grown there. Corn following sod may be seriously damaged.

Descriptive information prepared by entomologists at Iowa State University.

Cooperative Extension Service
IOWA STATE UNIVERSITY
Ames, Iowa 50011

February, 1976. . .PM 463-5

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CORN INSECTS — ABOVE GROUND

(Also See Picture Sheet No. 4)*

First Generation European Corn Borers

Most hybrid corn is partially resistant to first-generation corn borers. If favorable weather exists during the egg-laying period (June 15-30), some fields may need treatment. Seed cornfields should be treated when 25 percent of the plants show first-generation larval feeding in the whorl and plant dissection shows live larvae present; treatment should be repeated seven days later if feeding continues. Field corn should be treated when 50 percent of the plants are infested and larvae are present.

The following granular insecticides are recommended for corn borer control: Dyfonate, Furadan, Thimet, Sevin and toxaphene.

Second Generation European Corn Borers

In years with a heavy second generation moth flight, applicators should consider treating with the insecticides listed above between August 1-10. During this time, pollinating corn is most susceptible to attack.

Adult Rootworm Beetles

Beetle emergence prior to pollination may cause sufficient silk cutting to prevent pollination. When beetles are chewing silks before pollination, Sevin 4 Oil, Sevin 50W or 80S, malathion or diazinon may be applied. Generally, however, 10-15 beetles per silk must be present before treatment is justified. Late-planted or replanted corn is most attractive for beetle feeding. Commercial applicators may also use 4 ounces Di-Syston, ethyl parathion, methyl parathion or malathion ULV.

Armyworms

Corn with grassy weeds may be infested with armyworms. Applicators should treat when two larvae per plant are present on 25 to 30 percent of the plants that have five to six extended leaves or one larvae per plant on 75 percent of the plants. Insecticides recommended for armyworm control are diazinon, Dylox, malathion and Sevin. In addition, toxaphene can be used on corn grown for grain only on non-dairy farms.

Grasshoppers

Most crop spraying for grasshopper control can be avoided by closely observing populations in roadsides and fencerows. Small grasshoppers can easily be killed with insecticides applied to field margins and ditches before the grasshoppers move into crops. Insecticides recommended for grasshopper control are diazinon, Dibrom, malathion, Sevin or toxaphene.

Common Stalk Borers

No practical insecticidal control is available for common stalk borer control. In the future, systemic soil insecticides may be recommended, but none are currently labeled. Destruction of grass along fence rows and terraces where the insect overwinters in the egg stage will reduce infestation for the following year.

*Insect pests that are included on the picture sheets but not discussed in the text need not be studied for purposes of certification.

CORN INSECTS—ABOVE GROUND

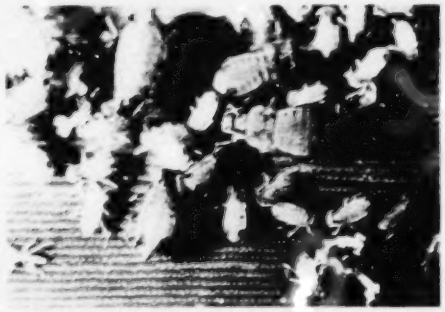
For safe and effective use of insecticides, always identify the problem correctly.

1. European corn borer (early leaf feeding and mature borers)

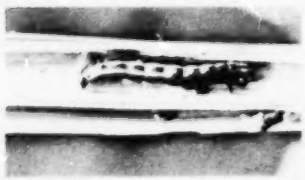
8. Grasshopper

2. Southwestern corn borer

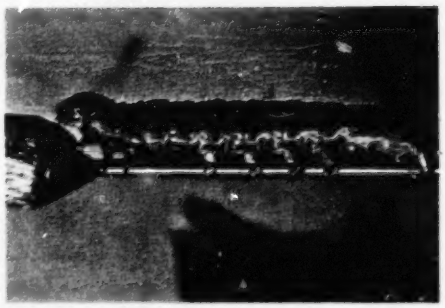
5. Corn earworm



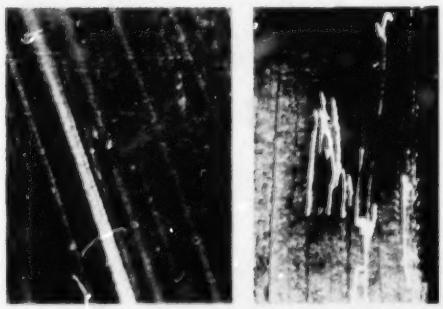
9. Corn leaf aphid



3. Common stalk borer



6. Armyworm



10. Corn flea beetle and damage

4. Chinch bug

7. Corn rootworm beetles (left to right: Northern, Western and Southern) These beetles clip silks causing poor pollination shown at far right.

Prepared by Extension Entomologists of the North Central States in cooperation with the Federal Extension Service, U. S. Department of Agriculture

CORN INSECTS -- ABOVE GROUND

1. **European corn borers** are flesh-colored, inconspicuously spotted, from ½ to 1 inch long, and bore into all parts of the corn stalk. The pest has destroyed complete crops of sweet corn. It has been found feeding on more than 200 kinds of plants. The insect passes the winter as a full-grown larvae and in the spring transforms into the adult moth. The adults begin emerging in May and again in July. Eggs are laid in groups of 5 to 50 on leaves of corn plants. The larvae feed until nearly half grown in mid ribs, under leaf sheaths, in the tassel, beneath the husks, or between the ear and the stalk. Later they eat into the stalk, the ear, or the shank of the ear and become borers.
2. **Southwestern corn borers** are not known to occur in Iowa. The mature larvae are 1½ to 2 inches long. There are two generations each year. The overwintering larvae girdle the corn stalk near ground level, then burrow into the base of the plant. Kansas, Missouri, and states south of these are infested.
3. **Stalk borers** injure corn plants on the margins of fields for two or three to 20 rows into the field. Holes are found in the stalks and inside are found active dark brown larvae from 3/4-inch to nearly 2 inches long. There is a single white stripe down the back, with broken white stripes on the sides. Larvae pupate and the adult is a moth, which emerges to lay overwintering eggs in August and September on grass and other plants. Reduced tillage fields or conventionally tilled fields that leave grass residues on the surface may have stalk borers throughout the field.
4. **Chinch bugs** are small, black and white or red and white insects found behind the sheaths of corn leaves or in the soil about the base of the plants, often with their slender beaks inserted in the plants from which they suck the sap. They feed on plants in the grass family, including wild and cultivated grasses, corn, and small grains. There are two generations each year. They overwinter as adults in trash.
5. **Corn earworms** have been called one of the worst pests of corn--perhaps two million acres are lost to the insect every year in the United States. Damage done includes eating of tip kernels, cutting off the silk, and preventing pollination. These worms vary from light green to nearly black. Marked with alternating light and dark lengthwise stripes, the head is yellow and the legs are dark. The adult is a moth which may lay as many as 3,000 eggs on fresh corn silks.
6. **Armyworms** attack all grass crops. Young worms are pale green and until half grown, feed at night. When food supplies are depleted and large populations exist, armies of the pests move on to the next field. Full-grown worms are nearly 1½ inches long, greenish-brown, with complex longitudinal stripes. They enter the ground and pupate, emerging as moths in from 14 to 20 days. There are from two to three generations each year.
7. **Northern corn rootworm** adults are green or tan beetles 1/4-inch long. They emerge from cornfields in July and August and feed on corn silks and pollen, sometimes to the extent of preventing pollination. Adults lay eggs in cornfield soils from July till frost. If corn is planted in the field the next year, larvae feed on roots during June and July.

   Western corn rootworm adults are tan or green with three black stripes running down the back. Adults do more damage to corn silks and leaves than the northern corn rootworms. Life histories of the two are similar, but the Western corn rootworms seem more active and are stronger fliers.

   Southern corn rootworm adults fly to Iowa from the south in late May and early June. They feed on corn leaves in any field. Eggs are laid in the soil at the base of corn plants. Adults are larger than those of the northern and western corn rootworms, and are also called spotted cucumber beetles. There are at least two generations in Iowa each year.
8. **Grasshoppers** that are pests of corn all pass the winter in the egg stage. These eggs are laid in packet-like masses nearly 1 inch long and from ½ to 1½ inches below the surface of the soil. When hatched, the young resemble the adults, and through a series of molts, grow to full-sized, winged adults.
9. **Corn leaf aphids** are greenish or greenish-blue pests found in the whorl and upper parts of the plant. Infested corn leaves are mottled with yellowish or reddish-yellow patches. By feeding on the tassels and coating them with honeydew, they may seriously interfere with pollination of corn. This insect migrates northward into Iowa each spring.
10. **Corn flea beetles** are responsible for the spread of bacterial wilt in the summer while feeding on corn leaves, and the bacteria overwinter in their gut. Only the overwintering beetles are of importance concerning injury to corn. Eggs are laid in the ground around the roots or underground stems. The larval stage is not well known.

Descriptive information prepared by entomologists at Iowa State University.

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IOWA STATE UNIVERSITY
Ames, Iowa 50011
February, 1976. . .PM 463-4

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COMMON SOYBEAN INSECTS

(Also See Picture Sheet No. 6)*

Green Cloverworms

The green cloverworm is an occasional pest of soybeans and is capable of severely damaging them if populations increase early in the summer. Economic infestation of 12 to 15 larvae per foot per row occurred in 1966, 1968, 1973 and 1975. When these infestation levels occur during stage 7 (pod fill), treatments are justified. Toxaphene, malathion and Sevin sprays are recommended.

Potato Leafhoppers

These small, yellow or green, wedge-shaped, sucking insects can damage soybeans in some years. Damage is most likely to occur when alfalfa hay that adjoins small soybeans is cut for the first time; the leafhoppers migrate to soybeans reducing the yield potential. Normally, the leafhopper infestation level in soybeans is not high enough to justify insecticide application. However, when leafhoppers are present in emerging to 12-inch tall soybeans growing next to recently cut alfalfa, the border rows should be sprayed with malathion or Sevin.

Grasshoppers

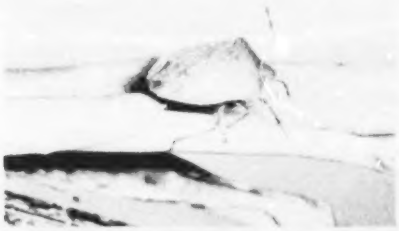
Applicators should observe field margins next to roads, ditches and terraces for grasshoppers and grasshopper defoliation of vegetation. Sprays of malathion, toxaphene and Sevin are more effective and economical when applied to localized field margins rather than waiting until grasshoppers are nearly mature and have moved throughout the field.

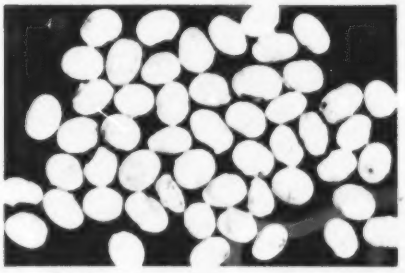
*Insect pests that are included on the picture sheets but not discussed in the text need not be studied for purposes of certification.

COMMON SOYBEAN INSECTS

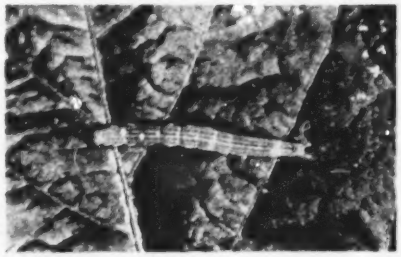
For safe and effective use of insecticides, always identify the problem correctly.

1. Bean leaf beetle



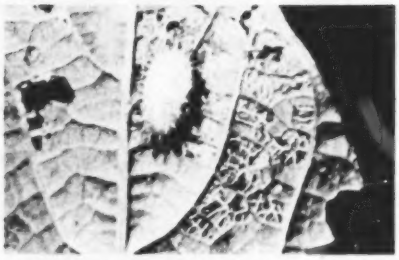


5. Green stink bug and damaged seeds

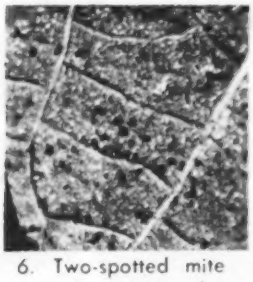


12. Green cloverworm

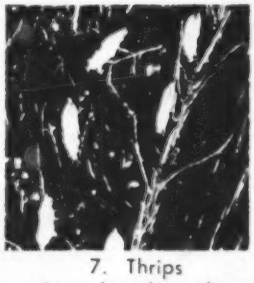
13. Cabbage looper



2. Mexican bean beetle and larva



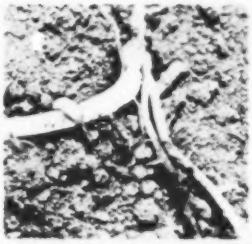
6. Two-spotted mite (not an insect)



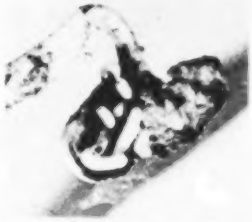
7. Thrips (greatly enlarged)

14. Garden webworm

3. Japanese beetle

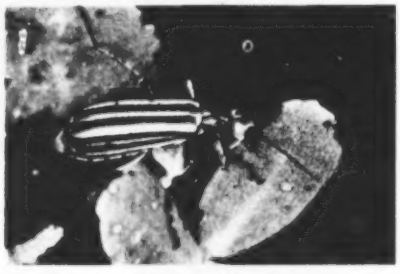


8. Grape colaspis larva

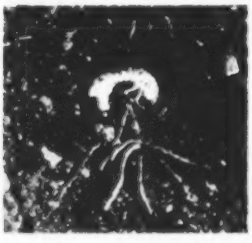


9. Seed maggot

15. Corn earworm



4. Striped blister beetle



10. White grub

11. Grasshopper

Prepared by Extension Entomologists of the North Central States in cooperation with the Federal Extension Service, U.S. Department of Agriculture

COMMON SOYBEAN INSECTS

1. **Bean leaf beetle** adults may feed on cotyledons of seedling plants, foliage, blossoms, and later upon pods. The larva feeds on soybean roots, which may allow disease organisms to become established. Adults overwinter in or near bean fields, and females deposit eggs in the soil near the plant base in the spring.
2. **Mexican bean beetle and larva** feed on the underside of leaves, giving them a lace-like appearance. The overwintering adults feed early in the season, and egg laying takes place on the underside of the leaves. A second generation may occur. This insect is destructive to soybeans in the southeastern states, but in Iowa it has been damaging only to garden beans in the eastern third of the state.
3. **Japanese beetle** adults may be found feeding on soybean foliage during mid-July in some states east of the Mississippi River. The species is a general feeder, eating foliage and fruits of more than 250 species of plants. It passes the winter as a larva, buried 3 to 12 inches underground in an earthen cell. In the spring, grubs burrow near the surface and feed on grass roots and other plants. Pupation occurs in the soil and adults emerge during July and August. Females lay eggs in vegetation-covered soil during late July and early August. The larvae resemble common white grubs but are smaller.
4. **Striped blister beetles** and other species of blister beetles have stripped leaves from large areas of soybean plants within a few days. This defoliation can have very serious consequences after pods have set. Blister beetles overwinter in the larval stage in an earthen underground cell. Pupation generally occurs in late spring. Adult beetles may emerge in great numbers during June and July. The adults tend to feed in groups and generally live four to six weeks. Females lay elongated, cylindrical eggs in the soil during July and August. This soft-bodied beetle is easily recognized by the yellow and black stripes traversing the length of the wing covers.
5. **Green stink bug** and damaged seeds became significant in 1959 when farmers were docked for stink bug-damaged beans. Nymphs and adults feed on pods and subsequently beans by inserting the beak and sucking out juices. Damaged beans may appear smaller than normal and may be wrinkled and misshapen. If feeding occurs when the pod is beginning development, it may be aborted. This insect is also believed to be one of the vectors of yeast-spot disease in soybeans. Stink bugs generally overwinter as adults in sheltered places such as fence rows, roadsides, ditch banks, and other protected situations. Females lay eggs in clusters of 30 or more on the underside of leaves. Hatching occurs in about a week and nymphs generally feed for 6 weeks before reaching adulthood. Two to three generations may occur each season.
6. **Two-spotted spider mite** becomes a problem on soybeans in mid- or late season. Immatures and adults of this species move into fields, puncture leaf surfaces, and feed on exuding liquids. Mite infestations often begin at edges of soybean fields and spread rapidly, especially during dry weather. Damage during the critical bean-forming period may result in serious yield loss. The female spider mite spins a fine web on the underside of leaves. Eggs are laid in the web, and six-legged immatures hatch in about 3 to 19 days. These feed for 1 or 2 weeks before maturation. The adult mite is variable in color, ranging from yellow to green to brown or orange. This group of arthropods has four pairs of legs in the adult stage as compared to the six found in all insect species.
7. **Thrips** are minute, fragile insects about 1/16 to 1/8 inch long. Feeding damage to leaves is caused by nymphs and adults rasping tissue near the veins and midrib, thus giving the leaf a speckled appearance. Eggs are generally deposited in slits in the soybean leaf and nymphs reach maturity in about two weeks. Most species of thrips produce many generations each season. Adult thrips are usually tan to dark brown and have four feather-like wings. Nymphs lack the fringed wings found in adults.
8. **Grape colaspis** may feed on soybean foliage as an adult but is probably a more important pest as a larva feeding upon roots. Larvae are small, comma-shaped grubs with brown heads. They may feed upon root hairs and may also scar roots. As a result of this feeding, plants may turn yellow and die. Infestations generally occur on second-year beans or following clover. Partially grown larvae pass the winter in soil, complete development in spring, pupate, and emerge as adults in June. Females lay eggs in summer and fall, and the resulting larvae feed until winter. Adults are light brown and have minute ridges on their wing covers.
9. **Seed-corn maggot,** as the name suggests, destroys corn seeds and sometimes attacks soybean seeds. Serious losses were reported from Illinois in 1967 because of this insect. Adult flies appear in early spring and lay eggs in moist soil where decaying vegetation is abundant. The resulting larvae begin feeding as scavengers but soon locate in developing beans. The maggot is a white spindle-shaped larva.
10. **White grub** larvae, as general feeders, can infest soybean fields. Large populations of these species, feeding on roots, are able to destroy sizable areas of a soybean field. The larva is a white, C-shaped grub with a brown head. Some species have a 3-year life cycle. Eggs are laid in the soil and hatch the first year. The second-year larvae feed all summer, followed by early season feeding and transformation the third year. The adult emerges in May or June of the following year as a large, dark-brown June beetle.
11. **Grasshoppers** of various species may feed on leaves and pods of soybeans in late July. Extensive damage occurs only occasionally and then locally. Economic species overwinter as eggs, which are laid in uncultivated soils in the fall. Nymphs hatch in early summer and reach maturity late in the summer season.
12. **Green cloverworm** larvae have been particularly destructive to soybeans in the South. These larvae defoliate the upper parts of the plant. This insect is not believed to overwinter in Iowa. Moths fly northward each spring and lay eggs on alfalfa and soybeans. Larval growth continues for nearly a month and the species pupates in a silken cocoon in ground litter. There are generally two generations per year in the North. The larvae are slender green "worms" with faint white stripes down the length of the abdomen and having three pairs of ventral prolegs plus a pair of anal prolegs.
13. **Cabbage loopers** may cause soybean defoliation damage. This is done late in the season by greenish larvae having a prominent white line along each side of the body and two others near the middle of the back. As opposed to the green cloverworm, this species has only two pairs of ventral prolegs in addition to the single anal pair. They overwinter as pupae in cocoons attached to the underside of a leaf. In spring, brown moths with a silvery spot near the middle of the wing emerge and lay eggs singly on soybean leaf surfaces. The larvae feed for 2 to 4 weeks and then pupate. The larvae move with a looping motion from which the common name is derived.
14. **Garden webworms** are general feeders, feeding upon many field and garden crops. Soybean leaves damaged by this species appear lace-like. Larvae are generally yellow-green in color with black spots on each body segment. The webworms spin a silken thread when they feed, thus leaves may be covered with webs. Winter is passed as a pupa, with adults emerging in the spring. Eggs are laid on soybean leaves in clusters, and larvae feed 3 or more weeks before pupation. There are probably two or three generations per year in the north.
15. **Corn earworm** larvae develop as late-season feeders on soybean pods and have substantially reduced soybean yields from mid-Missouri southward. In southern regions this species overwinters as a pupa and emerges as a light yellowish-brown moth with irregular lines on the wing. Adults lay eggs almost anywhere on the soybean plant when pods are beginning to fill, and larvae migrate to the pods to feed. There are two to three generations per year in southerly regions, but apparently pupae are unable to survive winter conditions north of 40° north latitude. Northern infestations, thus, are probably caused by adults migrating from the south. The larvae vary in color from green to brown or black. Alternate light and dark stripes traverse the length of the body. This species possesses 4 pairs of ventral abdominal prolegs in addition to the anal pair.

Descriptive information prepared by entomologists at Iowa State University.

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ALFALFA INSECTS

(Also See Picture Sheet No. 8)*

Alfalfa Weevils

When 25 percent of the tips show leaf feeding and alfalfa weevil larvae are present and the hay is seven days or more from cutting, insecticides should be applied in 20 gallons of water per acre. Furadan, Imidan, Lannate, malathion, Alfatox and Supracide are recommended; in addition, commercial applicators may also use ethyl or methyl parathion and Guthion. It is essential to maintain the proper interval between application and harvest. Early mowing often eliminates the need for insecticidal controls.

Potato Leafhoppers

Sprays should be applied when leafhoppers are present and typical "hopperburn" symptoms on leaf or yellowing of entire plant occurs. Cygon, diazinon, Guthion, malathion and Dylox are recommended. New seedings are particularly vulnerable to damage in years of high populations. Heavily infested fields will appear stunted and yellow.

Variegated Cutworms

The variegated cutworm is occasionally present in sufficient numbers to prevent alfalfa stubble from "greening-up" after first cutting is removed. Large worms are difficult to kill. Dylox in 20 gallons water per acre applied in the evening or an application of Sevin bait is recommended for control.

Pea Aphids

When excessive populations of pea aphids retard growth and cause plants to wilt, insecticide sprays should be applied. Cygon, diazinon, Guthion and malathion are recommended. Although present in every alfalfa field every year, very seldom will pea aphid populations become economic.

*Insect pests that are included on the picture sheets but not discussed in the text need not be studied for purposes of certification.

COMMON FORAGE LEGUME INSECTS

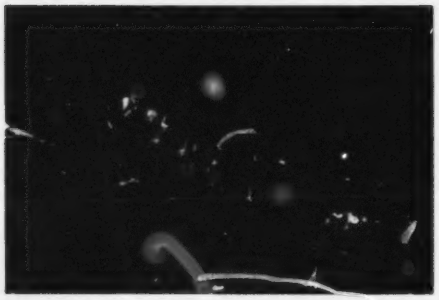
For safe and effective use of insecticides, always identify the problem correctly.

1. Alfalfa weevil adult, and larvae and damage

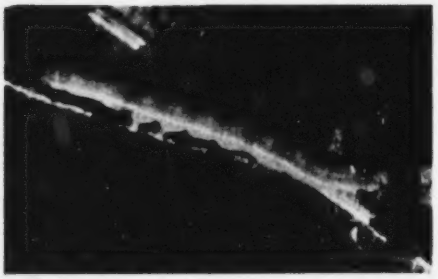
2. Clover leaf weevil larva

3. Sweetclover weevil and typical damage

4. Varigated cutworm

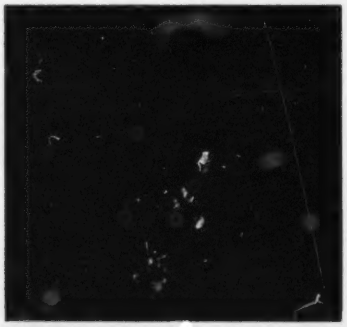


5. Grasshopper

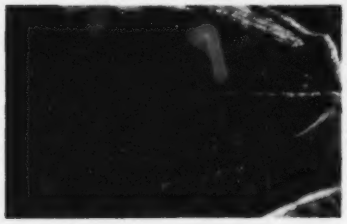


6. Green cloverworm

7. Potato leafhopper (greatly enlarged) and leafhopper damage to alfalfa



8. Meadow spittlebug and nymphs



9. Spotted alfalfa aphid

10. Pea aphid

Prepared by Extension Entomologists of the North Central States in cooperation with the Federal Extension Service, U.S. Department of Agriculture

COMMON FORAGE LEGUME INSECTS

1. **Alfalfa weevil** adults are 1/4 to 3/8 inch long and are brown with a darker streak down the back. The adults overwinter in ground debris and mate in the spring in Iowa. The female weevil eats into alfalfa stems, then lays 6 to 40 or more yellow eggs in this cavity. The eggs hatch into green, legless grubs with a black head and a white stripe down the back. The grubs skeletonize the terminal growth of the alfalfa plants. The major damage is to the first crop of alfalfa, although the weevil grubs are known to feed on red clover, sweetclover, and crown vetch. Adult weevils appear in late May and June, feed briefly, leave the field and are dormant until fall or spring when they become active again for a short time.
2. **Clover leaf weevil** adults are larger than the alfalfa weevils, as are the grubs. The grubs of the clover leaf weevil have a brown head. Feeding is done at night or on cloudy days. Grubs and adults hide in the crowns of clover plants during the day. An average of six grubs per plant will cause economic loss in a field of red clover. Adult clover leaf weevils mate in the fall and lay eggs loose in the crowns and stems of clover leaves. Some of these eggs hatch in the fall, others the following spring. Like the alfalfa weevil, there is only one generation each year.
3. **Sweetclover weevil** adult is 1/8 to 1/4 inch long, gray-brown in color, with a blunt snout. It lives through the winter hidden in ground debris. The damage is done by feeding on seedling sweetclover (and alfalfa) plants, reducing the stand. Eggs are laid in the soil, and the grubs feed on roots of established sweetclover without causing apparent damage. There is one generation each year.
4. **Variegated cutworm** adult is a large moth with dark front wings and pale hind wings. The larva is dark, with a yellow dot on the top in the middle of each segment. Full-grown larvae are 2 inches long. This species does not burrow in the ground. The larvae burrow into tomato fruits and cut off flower heads. They feed on alfalfa leaves, and occasionally this damage can be severe. There are probably three or four generations each year. The females lay their eggs in groups in a widely varying habitat, including on laundry hanging on lines, on curtains, walls, and other exposed areas.
5. **Grasshopper** shown is the differential grasshopper, which feeds on corn and other grasses rather than on alfalfa. There are four species of grasshoppers which have economic importance in Iowa. The red-legged grasshopper is most common in alfalfa and red clover fields. It is smaller than the differential grasshopper. These grasshoppers all live through the winter in the egg stage in the ground. The two-striped grasshopper also prefers alfalfa and clover as food. The fourth species, the migratory grasshopper, prefers grasses and grass crops but will feed on alfalfa to a limited extent. These last two species frequently have two generations per year in Iowa.
6. **Green cloverworm** as a full-grown larva is 1½ inches long, slender, with many fine white lines running lengthwise on the body. The anal prolegs are conspicuous. The adult moth has dark brown wings. Its body is 1 inch long. The green cloverworm does not overwinter in Iowa, but moths fly north from southern states in early summer.
7. **Potato leafhopper** adult is 1/8 inch long, slender, green, wedge-shaped, and very active. The nymph avoids detection by scurrying to the opposite side as leaves are examined. This insect has sucking mouthparts. It injects a toxin into the leaf as it sucks sap. This toxin causes "hopper burn," first in the leaf tips, then over the whole leaf. Damage is worst in dry periods. The potato leafhopper does not overwinter in Iowa, but comes north from the Gulf Coast States in May. There are two complete generations and usually a partial third. Eggs are laid in the leaf tissue. Nymphs grow to adults in 2 weeks.
8. **Meadow spittlebug** adult is ¼ inch long, thick bodied, widest at the head and tapering somewhat at the end of the abdomen. The color varies in individuals from pale tan to black. This species overwinters in the egg stage in the stems of many plants. The nymphs cover themselves with a froth composed of excreted sap whipped into bubbles. This "spittle" keeps the nymph from drying out and may protect it from enemies. Economic damage to alfalfa and clover occurs if there is an average of one spittle bug nymph per stem. Such heavy populations rarely occur in Iowa. There is only one generation each year.
9. and 10. **Spotted alfalfa aphid and pea aphid.** These two aphids are sucking insects which can stunt alfalfa when they are abundant in dry weather. The spotted alfalfa aphid feeds primarily on alfalfa, the pea aphid on both clovers and alfalfa. Both species overwinter in Iowa in the egg stage. During the summer all of the individual aphids are females which give birth to living young. In the fall males and females are produced. These mate and the females lay the eggs which overwinter.

Descriptive information prepared by entomologists at Iowa State University.

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SPECIAL THINGS TO CONSIDER WHEN APPLYING CROP INSECTICIDES

Preharvest and Re-entry Intervals

Many pesticides are restricted by a minimum time from last application to harvest. This time requirement is known as the preharvest interval. The label and extension pest control publications furnish needed information on this restriction. Preharvest intervals should be carefully observed to prevent harvesting an illegally contaminated product.

The minimum time between applying a chemical and workers entering the treated area is known as the re-entry interval. This restriction is presently required only for some pesticides that are highly toxic to warm blooded animals. Re-entry intervals should be carefully observed.

Phytotoxicity

When a chemical burns a plant to which it is applied, it is said to be phytotoxic (plant toxic). If the plant is a weed and the chemical a herbicide, the result is good, but usually the word phytotoxic is used when a pesticide adversely affects plants. Phytotoxicity may occur due to drift onto non-target plants, excessive rates, mixing of chemicals that are not toxic when used alone, and using chemicals in a more concentrated form than is desirable. Certain weather patterns may cause or increase the amount of phytotoxicity. Exceptionally bright, hot, dry weather following a period of cooler weather is such a situation. It is not unusual to get some phytotoxicity when using pesticides in accordance with recommended practices. It is unusual to have a severe phytotoxicity problem under these circumstances.

To avoid phytotoxicity, apply chemicals within recommended rates. Do not mix chemicals unless the label indicates it is all right. Time applications according to recommendations. Use recommended water rates.

Residues

The amount of a pesticide that remains after application is the residue. The ideal pesticide would be one that is residual enough to give control of a pest for the length of time needed and then breaks down into completely harmless chemicals. Unfortunately, this is not the case with most pesticides. The long residue nature of chlorinated hydrocarbons is one of the main reasons they are being used less. Usually a tolerance is set for each chemical that is registered on a crop. It is expressed in parts per million (ppm). The residue that remains on the harvested crop cannot exceed the tolerance set when the pesticide was labeled. This has a direct relationship to the preharvest interval. Registered and recommended rates should not be exceeded because the residue may exceed the legal tolerance.

The residue of pesticides in soils may create problems. If a chemical is legally used on one crop and it is not legal on the succeeding crop, an illegal residue may result. See the section on contamination of soil and water for additional information.

Insect Pest Resistance

Overuse of insecticides may cause problems. Some insect species have become resistant to once effective and widely used insecticides. For example, northern and western corn rootworms are resistant to chlorinated hydrocarbon insecticides. Insecticides should be thought of as production tools and used only when economic insect populations are likely to exist or when insect populations are increasing and crop yields will be reduced if the populations are not suppressed.

Depletion of Insect Parasites and Predators

The overuse and inappropriate use of insecticides may deplete or eliminate parasitic or predatory insect populations thus creating the need for more use of insecticides. Insecticides should be used only when and where they are needed.

Toxicity of Soil Insecticides

The organophosphate and carbamate soil insecticides are some of the most toxic insecticides that pesticide applicators may handle. Most of these chemicals are highly toxic and are used during one of the busiest times of the season—a time when a careless, hasty mistake can be costly. An applicator cannot afford to make a mistake with any pesticide, but a very small error in judgment can prove disastrous when highly toxic pesticides are involved. In spite of equipment breakdown, calibration problems and other planting-time slow-downs or interferences, extreme care must be followed when using organophosphate and carbamate soil insecticides and disposing of their empty containers.

Environmental Contamination

The long residual chlorinated hydrocarbon insecticides are the most likely chemicals to cause

contamination of the environment for an extended period. These chemicals should be used in strict accordance with recommendations. If possible, avoid using broadcast treatments over large areas.

a. **Nontarget Injury and Community Problems**

Care should be exercised not to contaminate nontarget areas when applying a pesticide. This is particularly true of food and feed crops, bodies of water, apiaries, woodlands, and urban areas. Information on the least hazardous recommended chemical to use where there is danger of contamination can be obtained from county extension offices.

Drift is probably the chief culprit contributing to contamination of nontarget areas. Pesticides should be applied when there is little or no wind. Under [illegible] conditions should pesticides be applied if wind exceeds 10 miles per hour. Using extremely low volume and air delivery spraying systems increases the problems of drift. Some pesticides may badly damage or completely destroy some crops if allowed to drift onto them.

Such precautions as spraying when there is little or no wind, using the least volatile forms of dangerous chemicals and avoiding breaking spray into very fine particles will help prevent these problems.

b. **Contamination of Soil and Water**

When pesticides are being used, care should be taken to prevent undue contamination of the soil and bodies of water. Select the pesticide least likely to cause contamination problems. For example, carefully mark each swath in order to avoid a double application. Some herbicides and long residual insecticides may have a carryover effect if excessive rates are used. This could contaminate or destroy subsequent crops.

When bodies of water are in close proximity to the area being treated, select the recommended chemical that would be least likely to contaminate the water. Apply the chemical when there is no wind or when the wind is in the direction to drift the chemical away from the water. Do not apply the chemical when heavy washing rain is probable.

SUGGESTED REFERENCES

IC-328	Summary of Iowa Insect Pest Control Recommendations
IC-428	Controlling the Alfalfa Weevil
Pm-617	Pesticide Calibration
Pm-176	European Corn Borer Control
Pm-670	Corn Rootworms and Their Control

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